EFFECTS OF BURNING ON VEGETATION AND RODENT POPULATIONS IN A LONGLEAF PINE TURKEY OAK ASSOCIATION IN NORTH CENTRAL FLORIDA

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This study considers some of the effects of a mid-winter burn on the vegetation and rodent populations in a longleaf pine-turkey oak association.

The importance of fire in the establishment and maintenance of longleaf pine-turkey oak (*Pinus australis-Quercus laevis*) associations in southeastern United States has been considered by Laessle (1942) and Garren (1943). In addition to fire, which has probably occurred since prehistoric times, logging activity in the southeast has removed much of the longleaf pine in such areas, allowing dominance by turkey oak (Laessle, *op. cit.*). This fire-climax association, more xeric than would probably be the case were fire not of such long standing importance, has been the subject of various studies by foresters primarily concerned with the effects of fire on forest species of economic importance (Heyward, 1939; Wahlenberg, et. al., 1939; Shepherd, 1953; Lay, 1955). Little attention appears to have been given to the influence of burning on the fauna of this community.

Description of the Study Area

The area is located 5 miles west of Gainesville, Alachua Co., Florida, and comprises several hundred acres of typical pine-oak land. The ratio of pine to oak varied from approximately 1 to 20 near the site of the burn in an area that had been recently logged, to approximately 1 to 2 in an area that had not been logged for nearly 25 years. The major ground plants consisted of perennial grasses (*Sporobolus, Aristida,* and *Andropogon*), chinquapin (*Castanea alnifolia*), dog fennel (*Eupatorium* spp.), and partridge pea (*Chamaecrista* sp.). The grasses formed a dense "mat" giving in some areas up to 100% cover at 1 ft. above the surface (Fig. 1). The area of the burn was dominated by turkey oak, with few mature solitary pines about which reproduction of the past 6 to 8 years was evident.

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According to local residents, the area had never been cultivated or grazed, but burning had occurred every 8 to 10 years for the past 30 years. The most recent burn was reported to have occurred in 1950, although growth rings on turkey oak sprouts and burn scars and growth of sapling pines indicated that the field was burned as recently as 3 or 4 years ago. The abundance of partridge pea and dog fennel provided further evidence of a more recent burn.

Local inhabitants reported that the area was most recently logged during 1952-53. Numerous unrotted pine stumps, 1½ to 2½ ft. in diameter, gave evidence of this cutting.

The area was burned by hunters during the first week of January, 1958. The extent of the burn was approximately 150 acres, and was limited by a sand road on the west and a semicircular narrow fire-break.

Methods

Vegetational studies consisted of a general survey of the area to determine the major herbaceous and shrubby plants. No attempt was made to make this survey inclusive. The more common plants were determined in order of abundance, along with a few other conspicuous forms. Relative abundance and ground cover were determined by the use of three 3 ft. x 50 ft. belt transects. Plant names follow Small (1933).

Small mammal populations were sampled at approximately 6 months, then at 6 and 4 weeks, prior to the burn, with trap lines consisting of 2 Sherman live traps per station, these latter spaced at intervals of 20 yds. Populations after the burning were estimated by three trap lines: one in the burned area, another along the fire break in unburned habitat, and another 100 yds. within the unburned area. Each line was composed of 10 stations with 2 traps per station. Trapping was conducted for 5 successive nights, twice in February, once each in March, April, May-June, and September.

Prior to the burning 150 trap-nights were recorded. Following the burning, 1800 trap-nights were recorded on the three established lines. All mammals taken alive were marked and released. An attempt to estimate mammal populations by the dropping board technique (Emlen, 1957) proved unsuccessful, since the animals were apparently not attracted to the boards to defecate. A

Figure 1. Unburned area in February, 1958; burned area similar prior to burning.

Figure 2. Burned area in February, 1958, one month after burning.

factor in this lack of response to the boards may have been the abundance of open sandy patches in the area.

Results

Vegetation: The heavy cover of the area prior to burning (Fig. 1) was composed primarily of clumps of perennial grasses and patches of dog fennels, partridge pea, chinquapin, and turkey oak saplings. The burn, coming after a hot and dry summer and fall destroyed virtually all ground cover (Fig. 2). Temperatures severely cold for this region occurred during January and February following the burn, so that cover was scanty for some time. The appearance of a number of species of plants was delayed by as much as a month past the normal.

Disregarding the usual seasonal variation, the first appreciable change in the aspect of the area occurred in March, with growth at the bases of burnt clumps of wire-grasses, and the emergence of chinquapin and turkey oak sprouts from underground stems. The few plants present did not alter the gross aspect of the area, however. Ground cover was no higher than 5% in the densest regions, and still completely lacking over most of the area.

In April, the aspect of the burned field had changed. From a distance of several hundred yards, the field appeared green and totally covered (Fig. 3). In reality, however, though ground cover was up to 10-15 per cent, it was not dense, but restricted to leaf cover one-two ft. above the ground. Vegetative reproduction by wire-grasses, turkey oak, chinquapin, bracken fern (*Pteridium aquilinum*), poison ivy (*Toxicodendron radicans*), and seedlings of partridge pea, made up the majority of the plants of the area. Also present were *Andropogon* sp., *Hymenopappus scabiosaeus, Berlandiera subacaulis, Lespedeza* spp., *Penstemon australis, Rhus copallinum,* and an unidentified panic grass. The large number of perennials present is a further indication of the frequency of the burnings in the area. Had the burnings been less frequent, a higher proportion of annuals would have been expected to have invaded the burned area soon after the fire.

The composites, poison ivy, partridge pea, and bracken fern were in far greater abundance in the burned area than in the unburned, where they occurred primarily along paths, and in areas of disturbance caused by pocket gophers (*Geomys pinetis*) and gopher turtles (*Gopherus polyphemus*). Seedlings of partridge

Figure 3. Burned area in April, 1958, three months after burning.

Figure 4. Burned area in June, 1958, five months after burning.

pea were estimated to be 10 to 20 times more abundant in the burned area.

By the end of May and early June, considerable growth of the established plants and an increase in ground cover were apparent (Fig. 4). Ground cover varied from 10-50 per cent over much of the area and averaged about 35 per cent. Poison ivy and bracken were less evident, whereas dog fennel, partridge pea, and *Andropogon* were more conspicuous. Other conspicuous plants making an appearance about this time were *Asclepias tuberosa, Rudbeckia* sp., *Bivonea* sp., *Ipomoea pandurata, Bradburya* sp., *Tetragonotheca helianthoides, Cuthbertia* sp., *Piriqueta caroliniana, Croton* sp., *Baccharis* sp., and *Vitis* sp.

No observations were made in July and August. In September ground cover was estimated at 50 per cent, though occasional bare patches of sand would reduce this considerably in some areas. The wire-grasses composed the majority of herbaceous vegetation, with considerable amounts of dog fennel, partridge pea (now dried and seeds discarded), chinquapin, and small turkey oaks. The major difference between the burned and unburned areas was the greater amount of dog fennel in the burned area, as opposed to a dense "mat" of wire-grass of the recent and preceeding seasons in the unburned area.

Mammal Populations: Some information on the small mammal population of the area prior to the burn was available. In June, 1957, 17 oldfield mice (*Peromyscus polionotus*), 1 Florida deer mouse (*Peromyscus floridanus*), and 6 cotton rats (*Sigmodon hispidus*) were taken in 100 trap-nights by J. N. Layne. My own trapping in December, 1957, yielded 5 oldfield mice and 5 cotton rats in 50 trap nights.

Within two weeks after burning, Layne and J. V. Griffo trapped in the area. Twenty-eight traps on the burned section took 12 oldfield mice, 1 Florida deer mouse, 1 house mouse (*Mus musculus*), and 2 least shrews (*Cryptotis parva*). An additional 12 traps in the unburned portion of the field took 3 oldfield mice and 3 Florida deer mice. The house mouse and shrews were not recorded in previous or subsequent trapping. It is impossible to learn whether they had been living on the area and only became susceptible to trapping following the burn or had moved into the area following the burn. Both forms were taken in the center of the area, possibly indicating residence.

The results of trapping on the lines established following the burn are given in Table 1. The dissimilarity between the burned section and unburned is obvious. No cotton rats were taken in the burned section although they were taken along the fire break where the traps were set on the unburned side. There was no considerable difference in the catch of oldfield and Florida deer mice in the two sections, although a somewhat greater number were taken in the burned section. Of the 178 captures listed in Table 1, 118 were original captures, 60 recaptures. The recapture rate for the three species involved was nearly identical.

TABLE 1

TOTAL CAPTURES OF MAMMALS IN A LONGLEAF PINE-TURKEY OAK ASSOCIATION IN NORTH-CENTRAL FLORIDA FOLLOWING A MID-WINTER BURN.

Area	Species	Feb. 2-7	Feb. 16-20	March 12-16	April 15-19	May 29-June 2	Sept. 15-19	Totals	Percentage
Burn	*P. polionotus*	12	15	18	18	4	1	65	88
	P. floridanus	0	1	3	3	2	0	9	12
	S. hispidus	0	0	0	0	0	0	0	0
Fire-Break	*P. polionotus*	5	8	9	4	0	1	27	49
	P. floridanus	1	1	0	0	0	0	2	4
	S. hispidus	6	3	6	7	4	0	26	47
Unburned	*P. polionotus*	8	8	5	0	0	0	21	43
	P. floridanus	2	2	1	0	0	0	5	10
	S. hispidus	1	3	10	5	4	0	23	47
Totals	(All species)	35	41	52	34	14	2	178	

Discussion

The effects of burning on game species has long received considerable attention from students of wildlife management. Stoddard (1931, 1935) has worked extensively on this aspect of quail

management, and Leopold (1933) and O'Neil (1949) have shown the effects of fire on other economically important species. The effects of fire on the flora of the southeast has likewise been centered on economic forms, especially forest trees (Garren, *op. cit.*).

Considering the ecological importance and frequency of fire in the southeast, the lack of data on its effects on small mammals is surprising. Elsewhere, though studies are few, there are some data on the effect of fire on small mammal populations. Baker (1940), working in the Texas grasslands, stated that fire was detrimental to rodent populations, but based his conclusions on a restricted area and a small number of animals. Rice (1932) showed that deer mice (*P. maniculatus*) and meadow mice (*Microtus ochrogaster*) deserted a field of grass (*Panicum* sp., and *Poa* sp.) in Illinois following a prairie burn. Tevis (1956) showed that save for isolated areas not burned fires in coniferous forests in northwestern California completely destroyed resident rodent populations. Cook (1959) found that all species of mice were annihilated in a mixed brush and grassland area in the Berkeley Hills region of California.

In the present study there appeared to be no over-all disturbance of rodent populations in the burned area. The cotton rat, because of its affinity for dense, grassy cover, was the only species adversely affected. Cook (*op. cit.*) found that *Microtus* was slow to move back into a burned area for essentially the same reason. In this study oldfield mice and Florida deer mice did not appear to be affected. In general these latter mice are more frequently found in open, sandy areas so that such burns do not apparently cause a change in the habitat sufficient to result in movement of these rodents.

Further evidence that no great net change in population occurred is the similarity of the composition of catches made prior to burning, and the composite catch for the burned and unburned portions of the area during this study (Table 2). This seems to indicate the rodent population was not greatly affected over the whole area, but, rather, that the cotton rats moved from the burned to the unburned portions. The resultant differences in the populations were due to population shifts rather than mortality. Since all three species dealt with commonly reside in burrows and temperatures generated by field burning are not excessive; certainly not compared to the intensity of slash burning described by Tevis (*op. cit.*), it appears that there would be slight mortality from a

burn in this habitat. The resultant changes in populations in a restricted area may result then from the flexibility of the forms involved to survive in an area following the burn. The observed changes in the population of the study area following the burn (Table 1) seem best explained by shifting populations rather than mortality.

TABLE 2

COMPARISON OF NUMBER OF RODENTS TAKEN FROM BURNED AND UNBURNED PORTIONS OF A LONGLEAF PINE-TURKEY OAK ASSOCIATION IN NORTH-CENTRAL FLORIDA PRIOR TO AND FOLLOWING A MID-WINTER BURN.

Species	Prior to Burning (150 trap-nights)	Percentage	After Burning (1800 trap-nights)	Percentage
P. polionotus	22	65%	113	63%
P. floridanus	1	3%	16	9%
S. hispidus	11	32%	49	28%
Totals	34	100%	178	100%

As was mentioned previously, the winter and spring of 1958 were unusually cold for this region (average minimum temperature was 36.1° F., whereas the 51 year average for the region during January and February is 47.9° F.). This apparently affected rodent populations and caused a poor spring breeding season, with a resultant lag in the seasonal build up of numbers. As early as May or June the cover in the burned area seemed dense enough to permit occupancy by cotton rats, although none was taken in the area. It is possible that under typical population levels the burned area would have been reoccupied by cotton rats within 6 months following the burn.

Summary

The vegetative development following a mid-winter burn in a longleaf pine-turkey oak association is briefly traced. Unusually cold temperatures during the winter and spring of 1958 retarded plant growth for at least several weeks. Composites, dog fennel, and partridge pea were more common in the burned than the unburned portion of the study area. Wire-grasses formed the major

plant cover on the unburned section, but were removed from the burned section, and affected at least part of the rodent population.

Trapping in the burned and unburned sections indicated cotton rats moved from the burned to the unburned portions of the field following the burn whereas population densities of oldfield and Florida deer mice remained essentially at pre-burn levels. Comparison of trapping results, prior to and following the burn, indicated that, fire was not detrimental to the rodent populations over the whole area, but caused a shifting of populations after the fire as a result of change in the habitat.

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